SECRET

Enclosure to C 15912

COPY 1 OF 5

PROPOSAL FOR

S-BAND ANTENNA REDESIGN

29 April 1957

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[redacted]

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including this title sheet.)

Included in Amendment 11

SECRET

1. Introduction

a. The purpose of the redesign of the S-band antenna for use with System 1 is to extend the frequency coverage of the System from the 2700 mc to 3000 mc of the original S-band design to 1 kmc to 8 kmc.

b. An antenna will be provided which can be installed in the same mounting area as the original antenna and which is capable of satisfactory operation over a range from 1 kmc to 8 kmc.

c. In addition, a set of coaxial-construction low and high pass filters will be provided so that the system will be capable of selecting the frequency ranges from 1 kmc to 2 kmc, 2 kmc to 4 kmc, 4 kmc to 8 kmc, 1 kmc to 4 kmc, 2 kmc to 8 kmc, and 1 kmc to 8 kmc by simply connecting the appropriate filter combinations to the antenna terminals.

d. Crystal video detectors which may be used with the system are of the tuned variety covering the 1 kmc to 2 kmc, 2 kmc to 4 kmc, and 4 kmc to 8 kmc ranges and/or a broadband detector utilizing the Sylvania Tripolar crystal which will operate over the entire 1 kmc to 8 kmc range with a sensitivity equivalent to that of the tuned detectors over their restricted ranges.

2. Physical Details of the Antenna

a. The new antenna is similar to the original in that it employs a dipole as a primary radiator illuminating a parabolic reflector. (See photo of developmental model.) However, the reflector has been increased in size from 11 1/2" to 16" and the primary radiator employed is a broadband dipole based upon a design originating at Stanford Electronics Laboratory.*

* "A Broadband, Directive, Microwave Antenna" by C. J. Shoens, and W. E. Dyer, Technical Report Number 608-1, March 11, 1957, Stanford Electronics Laboratory, Stanford, California

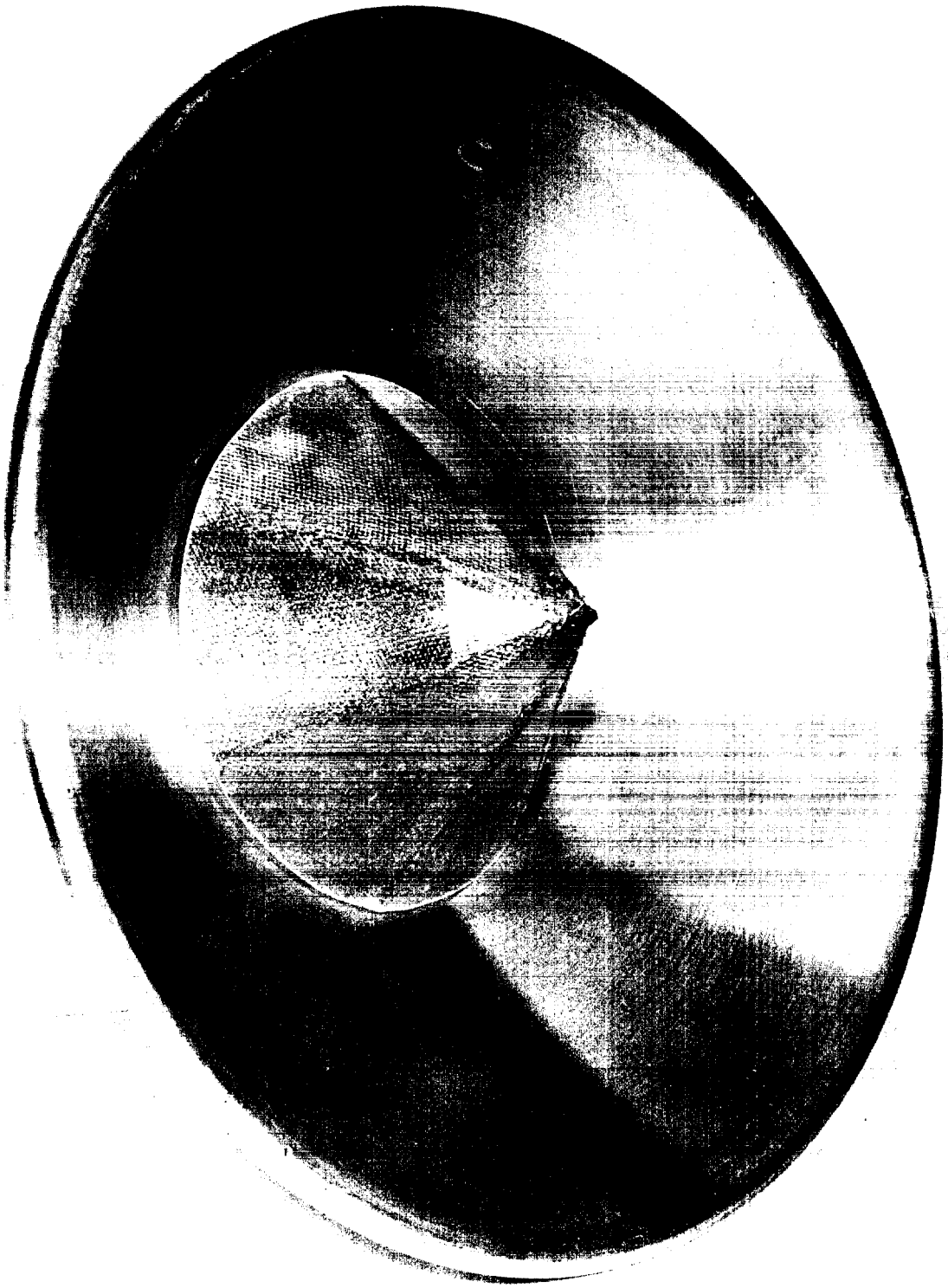
b. The dipole is a "bent bowtie" formed of 0.010" copper sheet, each half of which is an isosceles triangle two inches on a side. The dipole is secured by epoxy resin cement to a 0.20" thick fibreglass cone which has a 90° included angle, and the base of the cone is bolted to the 0.040" thick spun aluminum reflector. The halves of the dipole are provided with tabs at their apexes which are soldered to the inner and outer conductors of a rigid air-filled coaxial line extending through the center of the reflector.

c. A type N fitting provided with a mounting flange is attached to the coaxial line and the flange is bolted to the reflector. Thus, the coaxial line is bolted to the reflector at one end and cemented to the fibreglass cone at the other end, along with the dipole to which it connects, and the cone is bolted to the reflector. The reflector is attached to an annular mounting ring by the bolts which attach the cone to the reflector, and the mounting brackets for the entire antenna attach to this mounting ring. This type of construction provides a lightweight but very rigid antenna which may be securely attached without distortion to the airframe.

d. To improve the impedance match of the dipole to the 50-ohm coaxial line, the inner conductor of the feed line is tapered near its connection to the dipole. The coaxial line has an outer conductor of 5/16" outside diameter and 0.292" inside diameter. The inner conductor is tapered from 0.125" at the connector end to 0.055" at the feed point. The inner conductor is supported both by a styrafoam spacer and by its connection to the dipole at the feed point, and by the insulator of the type N fitting at the connector end. The feed point, i.e., the apex of the cone, is 4 1/2" from the reflector surface at the center. Inner and outer conductors of the coaxial line are of silver plated brass.

3. Electrical Performance of the Antenna

The antenna is expected to provide an essentially linearly polarized beam whose width to 3 db points in both principal planes varies from 50° at 1 kmc to 7° at 8 kmc. Its power gain with respect to a matched half wave dipole may be expected to vary from about 5 db at 1 kmc to 20 db at 8 kmc. Its VSWR should be less than 4.5 to 1 at any point within the band.



Experimental Model of Redesigned
S-Band Antenna